

Remarks

A. Pending Claims

Claims 1691-1743 are pending. Claims 466-469, 471-492, 494-507, and 509-518 have been cancelled.

B. The Claims Are Not Obvious Over EP130671 In View of Pritchett Pursuant To 35 U.S.C. §103(a)

Claims 466-469, 473-492, 494-497, 499, 500-507, and 510-518 were rejected under 35 U.S.C. §103(a) as being unpatentable over European Patent Application 0130671 to Rose (hereinafter “EP130671”) in view of U.S. Patent No. 3,757,860 to Pritchett (hereinafter “Pritchett”). Applicant respectfully disagrees with these rejections and believes that the new claims are not obvious in light of the cited art.

To reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 U.S.P.Q. 173, 177-178 (C.C.P.A. 1967). To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Claim 1691 describes a combination of features including:

one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface into the hydrocarbon containing layer, and at least one of the electrical conductors being electrically coupled to the AC supply;

at least one electrical conductor comprising an electrically resistive ferromagnetic material, the electrical conductor being configured to provide an electrically resistive heat output during application of AC to the electrical

conductor, and the electrical conductor being configured to provide a reduced amount of heat above or near a selected temperature, the selected temperature being within about 50 °C of the Curie temperature of the ferromagnetic material; and

wherein the system is configured to provide heat to the hydrocarbon containing formation such that sufficient heat transfers from at least one of the electrical conductors to hydrocarbons in the hydrocarbon containing formation to at least mobilize some hydrocarbons in the formation.

Claim 1710 describes a combination of features including:

one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface into the hydrocarbon containing layer, and at least one of the electrical conductors being electrically coupled to the AC supply;

at least one electrical conductor comprising an electrically resistive ferromagnetic material, the electrical conductor being configured to provide an electrically resistive heat output during application of AC to the electrical conductor, and the electrical conductor being configured to provide a reduced amount of heat above or near a selected temperature that is about 20% or less of the heat output at about 50 °C below the selected temperature, and wherein the selected temperature is at or about the Curie temperature of the ferromagnetic material; and

wherein the system is configured to provide heat to the hydrocarbon containing formation such that sufficient heat transfers from at least one of the electrical conductors to hydrocarbons in the hydrocarbon containing formation to at least mobilize some hydrocarbons in the formation.

Claim 1729 describes a combination of features including:

providing AC at a frequency between about 100 Hz and about 1000 Hz to one or more electrical conductors located in a heater well extending from a surface of the earth into a hydrocarbon containing layer in the formation, wherein providing the AC produces an electrically resistive heat output from the electrical conductors, at least one of the electrical conductors comprising one or more electrically resistive ferromagnetic sections, ...

allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.

The cited art does not appear to teach or suggest the combination of features set forth in the system claims including, but not limited to:

“one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface into the hydrocarbon containing layer, and at least one of the electrical conductors being electrically coupled to the AC supply;” and

“wherein the system is configured to provide heat to the hydrocarbon containing formation such that sufficient heat transfers from at least one of the electrical conductors to hydrocarbons in the hydrocarbon containing formation to at least mobilize some hydrocarbons in the formation.”

The cited art does not appear to teach or suggest the combination of features set forth in the method claims including, but not limited to:

“providing AC at a frequency between about 100 Hz and about 1000 Hz to one or more electrical conductors located in a heater well extending from a surface of the earth into a hydrocarbon containing layer in the formation, wherein providing the AC produces an electrically resistive heat output from the electrical conductors, at least one of the electrical conductors comprising one or more electrically resistive ferromagnetic sections;” and

“allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.”

EP130671 relates to autoregulation in a “relatively small device.” See page 8, line 20.

There is no teaching or suggestion in EP 130671 of any of the above-mentioned combinations of features. EP 130671 does not, for example, even mention wells or hydrocarbons. EP 130671 does not, for instance, have any teaching relating to “electrical conductors in a heater well and extending from the surface into the hydrocarbon containing layer,” “voltage above about 200 volts,” and/or transferring heat from “electrical conductors to hydrocarbons in the hydrocarbon layer to at least mobilize some hydrocarbons in the layer,” in combination with the other features in Applicant’s claims.

In fact, EP 130671 teaches away from the combinations of features in Applicant’s claims because EP 130671 refers to heating fluids **inside** of the device. Specifically, EP 130671 states: “It should be noted that the insulating layer 29 of Fig. 3 has been eliminated to provide a gap between return conductor 27 and ferromagnetic layer 31. This gap insulates such members from

one another and may be employed to heat fluids; air, gas, water, or other liquid, for a variety of purposes. Any one of the insulating layers may be removed to accept fluid and in fact, three different fluids may be heated simultaneously to three different temperatures.” (EP130671, page 17, lines 18-26). Applicant’s claims 1691 and 1710, however, refer to the combination of features including, but not limited to, “one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface **into the hydrocarbon containing layer**” and “**sufficient heat transfers from at least one of the electrical conductor to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer” (emphasis added). Applicant’s claim 1729 refers to the combination of features including, but not limited to, “providing an AC at a voltage above about 200 volts to one or more electrical conductors located in a heater well extending from a surface of the earth **into a hydrocarbon containing layer in the formation**” and “**allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer” (emphasis added).

Pritchett does not teach any of the above-mentioned combinations of features. While Pritchett does refer to heaters below the ground in permafrost zones, these heaters are not in any hydrocarbon containing layer. Pritchett states: “Well 2, for sake of simplicity, shows a simplified wellhead 3 composed of an outer longitudinally extending pipe or casing 4 having substantially concentric therein a longitudinally extending inner pipe or tubing 5, both pipes **extending through permafrost zone 6 into unfrozen earth 7.**” (Pritchett, column 4, lines 15-21). Applicant’s claims 1691 and 1710, however, refer to the combination of features including, but not limited to “one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface **into the hydrocarbon containing layer**” (emphasis added). Applicant’s claim 1729 refers to the combination of features including, but not limited to, “providing an AC at a voltage above about 200 volts to one or more electrical conductors located in a heater well extending from a surface of the earth **into a hydrocarbon containing layer in the formation**” (emphasis added).

Significantly, Pritchett teaches away from the combination of features in Applicant’s

claims. Pritchett teaches, for example, **low degrees of heating** are used to maintain thermal equilibrium between a production well and a permafrost zone and prevent thermal cycling of the production well and the permafrost zone when fluid flow in the production well is low or stopped. The **low degrees of heating** may also be used to prevent hydrate formation and/or make fluid in the production well more pumpable. While Pritchett does refer to heating below the ground, the heating does not take place in any hydrocarbon containing layer and does not mobilize any hydrocarbons in any hydrocarbon containing layer.

Pritchett states: “By following the method of this invention, sufficient heating of the pipe at least in a limited zone, e.g., a permafrost zone, is achieved to prevent hydrate formation, to cause thawing, to prevent thermal cycling above and below the freezing point of water, or to render produced liquid more fluid while still using a safe voltage.” (Pritchett, column 2, lines 54-59). Pritchett further states: “The heating achieved by this invention is **normally no greater than the heating effected by normal production of warm fluid** through the well so that any permafrost that may be present is **not subjected to any greater degree** of heat than that which is normal for the producing well. Where the flow rate, temperature and thermal properties of the produced fluid are such that the permafrost would refreeze, then heating by the method of this invention can be employed to prevent thermal cycling. In wells that do not pass through a permafrost zone more heating can be tolerated and can be provided by this invention to, for example, reduce hydrate formation or render produced fluid more pumpable.” (Pritchett, column 3, lines 6-18). Applicant’s claims 1691 and 1710, however, refer to the combination of features including, but not limited to “one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface **into the hydrocarbon containing layer**” and “**sufficient heat transfers from at least one of the electrical conductor to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer” (emphasis added). Applicant’s claim 1729 refers to the combination of features including, but not limited to, “providing an AC at a voltage above about 200 volts to one or more electrical conductors located in a heater well extending from a surface of the earth **into a hydrocarbon containing layer in the formation**” and “**allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer** to at least

mobilize some hydrocarbons in the layer” (emphasis added).

Applicants submits that the cited art does not appear to teach or suggest all of the features in claims 1691, 1710, 1729, and the claims dependent thereon.

C. The Claims Are Not Obvious Over EP130671 In View of Pritchett And Further In View of Vanegmond Pursuant To 35 U.S.C. §103(a)

Claims 471, 498, and 509 were rejected under 35 U.S.C. §103(a) as being unpatentable over EP130671 in view of Pritchett and further in view of U.S. Patent No. 4,572,299 to Vanegmond et al. (“Vanegmond”). Applicant respectfully disagrees with this rejection and believes that the new claims are not obvious in light of the cited art.

Claims 471 and 509 described combinations of features including the feature of: “wherein the heater system is configured to provide heat to a hydrocarbon containing formation, and wherein the heater system is configured to pyrolyze at least some hydrocarbons in the formation.” Claim 498 described a combination of features including the feature of “further comprising allowing heat to transfer from the electrical conductor to at least a part of a hydrocarbon containing formation, and pyrolyzing at least some hydrocarbons in the formation.” New claims 1694 and 1713 each describe a combination of features including the feature of “wherein at least one electrical conductor transfers heat to hydrocarbons in the hydrocarbon containing layer to pyrolyze at least some hydrocarbons in the layer.” New claim 1731 describes a combination of features including the feature of “wherein the transferred heat pyrolyzes at least some hydrocarbons in the hydrocarbon containing layer.”

For at least the reasons cited above in section B of this document, EP130671 and Pritchett do not appear to teach, suggest, or provide motivation for the above-quoted features of the claims.

D. Dependent Claims

Applicant submits that many of the claims dependent on claims 1691, 1710, and 1729 are

separately patentable.

Claims 1692 and 1711 describe combinations of features including: “at least one production well extending into the hydrocarbon containing layer and configured to produce at least some of the mobilized hydrocarbons from the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1692 and 1711, in combination with the other features of the claims.

Claims 1693 and 1712 describe combinations of features including: “wherein at least one electrical conductor transfers heat during use to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1693 and 1712, in combination with the other features of the claims.

Claims 1694 and 1713 describe combinations of features including: “wherein at least one electrical conductor transfers heat during use to hydrocarbons in the hydrocarbon containing layer to pyrolyze at least some hydrocarbons in the layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1694 and 1713, in combination with the other features of the claims.

Claims 1695 and 1714 describe combinations of features including: “wherein the heater well extends from the surface of the earth through an overburden of the formation into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1695 and 1714, in combination with the other features of the claims.

Claims 1696 and 1715 describe combinations of features including: “wherein at least one of the ferromagnetic sections heats during use to a temperature of at least about 650 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1696 and 1715, in combination with the other features of the claims.

Claims 1697 and 1716 describe combinations of features including: “wherein the AC supply is coupled to a supply of line current, and wherein the AC supply is configured to provide AC at about three times the frequency of the line current.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1697 and 1716, in combination with the other features of the claims.

Claims 1698 and 1717 describe combinations of features including: “wherein the AC supply is configured to provide AC with a frequency between about 140 Hz and about 200 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1698 and 1717, in combination with the other features of the claims.

Claims 1699 and 1718 describe combinations of features including: “wherein AC supply is configured to provide AC with a frequency between about 400 Hz and about 550 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1699 and 1718, in combination with the other features of the claims.

Claims 1700 and 1719 describe combinations of features including: “wherein the ferromagnetic material comprises iron, nickel, chromium, cobalt, tungsten, or a mixture thereof.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1700 and 1719, in combination with the other features of the claims.

Claims 1701 and 1720 describe combinations of features including: “wherein a thickness of the ferromagnetic material is at least about ¾ of a skin depth of the AC at the Curie temperature of the ferromagnetic material.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1701 and 1720, in combination with the other features of the claims.

Claims 1702 and 1721 describe combinations of features including: “wherein the heat output below the selected temperature is greater than about 400 watts per meter of the electrical

conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1702 and 1721, in combination with the other features of the claims.

Claims 1703 and 1722 describe combinations of features including: “wherein at least a portion of at least one of the electrical conductors is longer than about 10 m.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1703 and 1722, in combination with the other features of the claims.

Claims 1704 and 1723 describe combinations of features including: “wherein the system is configured to sharply reduce the heat output at or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1704 and 1723, in combination with the other features of the claims.

Claims 1705 and 1724 describe combinations of features including: “wherein the system is configured such that the heat output of at least a portion of the system decreases at or near the selected temperature due to the Curie effect.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1705 and 1724, in combination with the other features of the claims.

Claims 1706 and 1725 describe combinations of features including: “wherein the system is configured to apply AC of at least about 70 amps to at least one of the electrically resistive sections.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1706 and 1725, in combination with the other features of the claims.

Claims 1707 and 1726 describe combinations of features including: “wherein at least one of the electrical conductors comprises a turndown ratio of at least about 2 to 1.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1707 and 1726, in combination with the other features of the claims.

Claims 1708 and 1727 describe combinations of features including: “wherein the system

is configured to withstand operating temperatures of about 250 °C or above.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1708 and 1727, in combination with the other features of the claims.

Claims 1709 and 1728 describe combinations of features including: “wherein the electrical conductor is configured to automatically provide the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1709 and 1728, in combination with the other features of the claims.

Claim 1730 describes a combination of features including: “producing at least some of the mobilized hydrocarbons from the layer through a production well extending into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1730, in combination with the other features of the claim.

Claim 1731 describes a combination of features including: “wherein the transferred heat pyrolyzes at least some hydrocarbons in the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1731, in combination with the other features of the claim.

Claim 1732 describes a combination of features including: “producing at least some of the pyrolyzed hydrocarbons from the layer through a production well extending into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1732, in combination with the other features of the claim.

Claim 1733 describes a combination of features including: “wherein the heater well extends from the surface of the earth through an overburden of the formation into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1733, in combination with the other features of the claim.

Claim 1734 describes a combination of features including: “wherein at least one of the ferromagnetic sections heats to a temperature of at least about 650 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1734, in combination with the other features of the claim.

Claim 1735 describes a combination of features including: “providing an initial electrically resistive heat output when the electrical conductor providing the heat output is at least about 50 °C below the selected temperature, and automatically providing the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1735, in combination with the other features of the claim.

Claim 1736 describes a combination of features including: “providing the AC at about three times the frequency of line current from an AC supply.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1736, in combination with the other features of the claim.

Claim 1737 describes a combination of features including: “providing the AC at a frequency between about 140 Hz and about 200 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1737, in combination with the other features of the claim.

Claim 1738 describes a combination of features including: “providing the AC at a frequency between about 400 Hz and about 550 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1738, in combination with the other features of the claim.

Claim 1739 describes a combination of features including: “wherein a thickness of at least one of the ferromagnetic sections is at least about $\frac{3}{4}$ of a skin depth of the AC at the Curie temperature of the ferromagnetic material.” The cited art does not appear to teach or suggest at

least the above-quoted features of claim 1739, in combination with the other features of the claim.

Claim 1740 describes a combination of features including: “providing a reduced amount of heat above or near the selected temperature of less than about 400 watts per meter of length of the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1740, in combination with the other features of the claim.

Claim 1741 describes a combination of features including: “controlling a skin depth in the electrical conductor by controlling a frequency of the AC applied to the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1741, in combination with the other features of the claim.

Claim 1742 describes a combination of features including: “controlling the amount of current applied to the electrical conductors to control an amount of heat provided by at least one of the electrically resistive sections.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1742, in combination with the other features of the claim.

Claim 1743 describes a combination of features including: “applying current of at least about 70 amps to the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1743, in combination with the other features of the claim.

E. Provisional Double Patenting Rejections

Claims 466-469, 471 and 473-492, 494-507, and 509-518 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 268-408, 625, 659, 685, and 710 of copending U.S. Pat. Appl. No. 10/693,816 in view of EP130671. Claims 466-469, 471 and 473-492, 494-507, and 509-518 have been cancelled.

F. Additional Comments

Applicant believes no fees are due with the filing of this document. If an extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees are required or if any fees have been overpaid, please appropriately charge or credit those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-21000/EBM.

Respectfully submitted,



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